Claims

1. A motor comprising

an armature (3) and a field element (2) which are rotatable relative to each other on a rotation axis (21) extending in a first direction (L), wherein

said armature (3) includes

an armature winding (7) which is placed at a distance in a second direction (D) perpendicular to said first direction (L), from said rotation axis (21), and

said field element (2) includes:

a plurality of first yoke plates (41) each including one end which faces said armature winding (7) in said first direction (L) and the other end which does not face said armature winding (7) in said first direction (L), each of said plurality of first yoke plates (41) extending in said second direction (L); and

a magnetic-field creating magnet (5) which has a north pole joined to said other end of one of adjacent first yoke plates (41) of said plurality of first yoke plates (41), a south pole joined to said other end of the other of said adjacent first yoke plates (41), and a U-shaped magnetic path (Φ1) which opens to said plurality of first yoke plates (41), said magnetic-field creating magnet (5) at least locally facing said armature winding (7) in said second direction (D).

2. The motor according to claim 1, wherein

said one ends of said adjacent first yoke plates (41) are connected to each other.

3. The motor according to claim 1, wherein

said other ends of said adjacent first yoke plates (41) are connected to each other such that a junction between said other ends of said adjacent first yoke plates (41)

does not overlie a boundary between said north pole and said south pole.

4. The motor according to claim 1, wherein

each of said plurality of first yoke plates (41) includes a linear outline (411) parallel to said second direction (D).

5. The motor according to claim 1, wherein

an interval (461) between said adjacent first yoke plates (41) increases as a distance from said rotation axis (21) increases in said second direction (D).

6. The motor according to claim 5, wherein

said interval (461) between said adjacent first yoke plates (41) non-linearly increases in proportion to said distance from said rotation axis (21).

7. The motor according to claim 1, wherein

said magnetic-field creating magnet (5) is disc-shaped.

8. The motor according to claim 1, wherein

said magnetic-field creating magnet (5) includes:

at least one permanent magnet (51) in which a north pole and a south pole are laid side by side in said first direction (L); and

a second yoke plate (59) which joins said north pole and said south pole of said permanent magnet on a side opposite to a side on which said plurality of first yoke plates (41) are placed.

9. The motor according to claim 1, wherein

said magnetic-field creating magnet (5) includes:

at least two hexahedron-shaped permanent magnets (53) in each of which a north pole and a south pole are laid side by side in said first direction (L); and

a second yoke plate (59) which joins said south pole and said north pole of each of said permanent magnets (53) on a side opposite to a side on which said plurality of first yoke plates (41) are placed.

10. The motor according to claim 8, wherein

said permanent magnet (51, 53) is a bonded-magnet.

11. The motor according to claim 10, wherein

said permanent magnet (51, 53) is formed integrally with either said plurality of first yoke plates (41) or said second yoke plate (59) by injection molding.

12. The motor according to claim 8, wherein

a width of said second yoke plate (59) extending in said second direction (D) is larger than a width of said permanent magnet (51, 53) extending in said second direction (D).

13. The motor according to claim 8, wherein

a width of said second yoke plate (59) extending in said first direction (L) is larger than a width of said permanent magnet (51, 53) extending in said first direction (L).

14. The motor according to claim 8, wherein

a portion extending along a portion of said permanent magnet (51, 53) where different polarities are adjacent has a larger width extending in said first direction (L) than said other portions in said second yoke plate (59).

15. The motor according to claim 1, wherein

said armature (3) further includes a substrate (76) on which said armature winding (7) is placed.

16. The motor according to claim 15, wherein

said armature winding (7) is placed on each of surfaces of said substrate (76) which are opposite to each other in said first direction (L).

17. The motor according to claim 16, wherein

said armature winding (7) placed on one of said surfaces of said substrate (76) and said armature winding (7) placed on the other of said surfaces of said substrate (76) are misaligned with each other in a rotation direction (R) of said field element (2) which is defined based on said armature (3).

18. The motor according to claim 15, wherein

said armature winding (7) is a flat coil in which a conductor is formed by a photolithographic process.

19. The motor according to claim 1, wherein

said armature (3) and said field element (2) are paired to form one motor set,

and

a plurality of motor sets are connected to be arranged in said first direction (L), said plurality of motor sets being centered on said rotation axis (21) in common.

20. The motor according to clam 19, wherein

said armature windings (7) respectively included in said plurality of motor sets are misaligned with one another in a rotation direction (R) of said field element (2) which is defined based on said armature (3).

21. The motor according to claim 1, wherein

said armature winding (7) is placed closer to said rotation axis (21) than said magnetic-field creating magnet (5), and

said field element (2) and another field element (2) similar to said field element (2) are connected to each other to be arranged in said first direction (L) with said armature (3) being interposed therebetween, said field elements (2) being centered on said rotation axis (21) in common.

22. The motor according to claim 1, wherein

each of said first yoke plates (41) includes a first flat portion (41a) which forms an air gap (74) in a space between said first flat portion (41a) and said armature winding (7), and a second flat portion (41b) connected to said first flat portion (41a), and

said first flat portion (41a) is placed closer to said armature winding (7) than said second flat portion (41b) in said first direction (L).

23. The motor according to claim 1, wherein

said armature (3) further includes at least one position detection sensor (6) for detecting a position of a magnetic pole of said magnetic-field creating magnet (5), and

said position detection sensor (6) is placed in a substantially central region of said armature winding (7).

24. The motor according to claim 1, wherein

said armature (3) further includes at least one position detection sensor (6) for detecting a position of a magnetic pole of said magnetic-field creating magnet (5), and

said position detection sensor (6) is displaced with respect to a line (d1) extending from said rotation axis (21) to a substantially central region of said armature winding (7) in a direction opposite to a rotation direction (R) of said field element (2) which is defined based on said armature (3).

25. The motor according to claim 23, further comprising

drive means for supplying either rectangular-wave or sinusoidal drive current to said armature winding (7) based on an output of said position detection sensor (6).

26. The motor according to claim 1, further comprising:

means for detecting an induced voltage of said armature winding (7);

means for estimating a position of a magnetic pole of said magnetic-field creating magnet (5) from said induced voltage; and

drive means for supplying a drive current based on said estimated position of said magnetic pole of said magnetic-field creating magnet (5) to said armature winding (7).

27. The motor according to claim 26, wherein

said drive means sets a phase of said drive current forward to a phase of said induced voltage.

28. A motor comprising:

an armature (3) including an armature winding (7) and a first yoke plate (31) which are stacked in one direction (L); and

a field element (2) which includes a magnetic-field creating magnet (5) having magnetic poles which are laid side by side in said one direction (L) and are different from each other in polarity, said field element (2) being rotatable relative to said armature on a rotation axis (21) extending in said one direction (L), wherein

said first yoke plate (31) includes a non-conductive part (241, 242) extending in a rotation direction (R) of said field element (2).

29. The motor according to claim 28, wherein

said non-conductive part (241, 242) includes a plurality of slits (241) which are arranged along a circle centered on said rotation axis (21).

30. The motor according to claim 29, wherein

said plurality of slits (241) are arranged such that at least one of said plurality of slits (241) is present in a position at every angle along said rotation direction (R) in a range between said rotation axis (21) and a periphery of said first yoke plate (31).

31. The motor according to claim 28, wherein

said first yoke plate (31) includes a plurality of magnetic plates (31a, 31b, 31c,

31d) having a boundary extending along at least one circle centered on said rotation axis (21), and

said non-conductive part (241, 242) includes said boundary (242) between said plurality of magnetic plates.

32. The motor according to claim 31, wherein

an insulating coating is provided on said boundary (242) between said plurality of magnetic plates.

33. The motor according to claim 28, wherein

said armature winding (7) and said magnetic-field creating magnet (5) overlap each other in a direction (D) extending from said rotation axis (21) toward a periphery of said first yoke plate (31).

34. The motor according to claim 33, wherein

said magnetic-field creating magnet (5) includes a plurality of subsidiary magnets (52) each having magnetic poles which are laid side by side in said one direction and are different from each other in polarity,

said plurality of subsidiary magnets (52) are arranged such that different polarities are alternately provided around said rotation axis (21) and a boundary between said different polarities extends in said direction extending toward said periphery,

said field element (2) includes:

a second yoke plate (2) which includes a first portion (41a) facing said armature winding (7) in said one direction (L) and a second portion (41b) connected to one side of said magnetic-field creating magnet (5) which is opposite to a side on which

said armature is placed, said second yoke plate (4) being placed orthogonally to said rotation axis (21); and

a third yoke plate (59) which joins said different polarities provided on said side of said magnetic-field creating magnet (5) on which said armature is placed, and

said second yoke plate (4) includes a non-magnetic part (46) extending in said direction (D) extending toward said periphery on a boundary between said plurality of subsidiary magnets (52).

35. A blower comprising:

said motor recited in any of claims 1 through 34; and

a fan (91) which is rotated by said motor.

36. A compressor comprising

said motor recited in any of claims 1 through 34; and

a compressing mechanism (96) which is rotated by said motor.

37. An air conditioner comprising:

said motor recited in any of claims 1 through 34; and

a rotation driving mechanism which is rotated by said motor.